EXERCISE 15.1   **PAGE NO: 15.10**

Solve the following linear Inequations in R.

1. Solve: 12x < 50, when
(i) x ∈ R
(ii) x ∈ Z
(iii) x ∈ N
Solution:
Given:
$12x < 50$
So when we divide by 12, we get
$12x/12 < 50/12$
$x < 25/6$
(i) x ∈ R
When x is a real number, the solution of the given inequation is (-∞, 25/6).

(ii) x ∈ Z
When, $4 < 25/6 < 5$
So when, when x is an integer, the maximum possible value of x is 4.
The solution of the given inequation is {…, –2, –1, 0, 1, 2, 3, 4}.

(iii) x ∈ N
When, $4 < 25/6 < 5$
So when, when x is a natural number, the maximum possible value of x is 4. We know that the natural numbers start from 1, the solution of the given inequation is {1, 2, 3, 4}.

2. Solve: -4x > 30, when
(i) x ∈ R
(ii) x ∈ Z
(iii) x ∈ N
Solution:
Given:
$-4x > 30$
So when we divide by 4, we get
$-4x/4 > 30/4$
$-x > 15/2$
$x < -15/2$
(i) x ∈ R
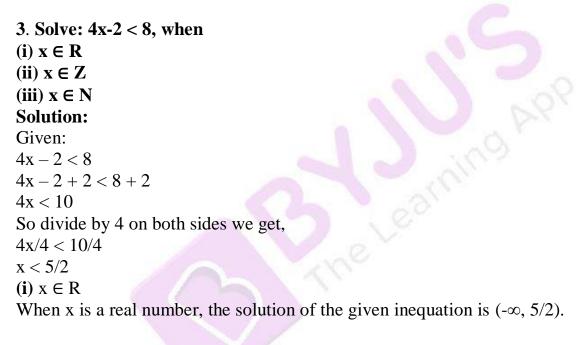
When x is a real number, the solution of the given inequation is (-∞, -15/2).

(ii) x ∈ Z
When, -8 < -15/2 < -7
So when, when x is an integer, the maximum possible value of x is -8.
The solution of the given inequation is {…, –11, –10, -9, -8}.

(iii) x ∈ N
As natural numbers start from 1 and can never be negative, when x is a natural number,
the solution of the given inequation is ∅.

3. **Solve: 4x-2 < 8, when**
(i) x ∈ R
(ii) x ∈ Z
(iii) x ∈ N
Solution:
Given:
$4x - 2 < 8$
$4x - 2 + 2 < 8 + 2$
$4x < 10$
So divide by 4 on both sides we get,
$4x/4 < 10/4$
$x < 5/2$
(i) x ∈ R
When x is a real number, the solution of the given inequation is (-∞, 5/2).

(ii) x ∈ Z
When, 2 < 5/2 < 3
So when, when x is an integer, the maximum possible value of x is 2.
The solution of the given inequation is {…, –2, –1, 0, 1, 2}.

(iii) x ∈ N
When, 2 < 5/2 < 3
So when, when x is a natural number, the maximum possible value of x is 2. We know
that the natural numbers start from 1, the solution of the given inequation is {1, 2}.

4. 3x – 7 > x + 1
Solution:
Given:

3x – 7 > x + 1
3x – 7 + 7 > x + 1 + 7
3x > x + 8
3x – x > x + 8 – x
2x > 8
Divide both sides by 2, we get
2x/2 > 8/2
x > 4
∴ The solution of the given inequation is (4, ∞).

5. x + 5 > 4x – 10
Solution:
Given: x + 5 > 4x – 10
x + 5 – 5 > 4x – 10 – 5
x > 4x – 15
4x – 15 < x
4x – 15 – x < x – x
3x – 15 < 0
3x – 15 + 15 < 0 + 15
3x < 15
Divide both sides by 3, we get
3x/3 < 15/3
x < 5
∴ The solution of the given inequation is (-∞, 5).

6. 3x + 9 ≥ –x + 19
Solution:
Given: 3x + 9 ≥ –x + 19
3x + 9 – 9 ≥ –x + 19 – 9
3x ≥ –x + 10
3x + x ≥ –x + 10 + x
4x ≥ 10
Divide both sides by 4, we get
4x/4 ≥ 10/4
x ≥ 5/2
∴ The solution of the given inequation is (5/2, ∞).

7. 2 (3 - x) ≥ x/5 + 4
Solution:

Given: 2 (3 - x) ≥ x/5 + 4
6 – 2x ≥ x/5 + 4
6 – 2x ≥ (x+20)/5
5(6 – 2x) ≥ (x + 20)
30 – 10x ≥ x + 20
30 – 20 ≥ x + 10x
10 ≥11x
11x ≤ 10
Divide both sides by 11, we get
11x/11 ≤ 10/11
x ≤ 10/11
∴ The solution of the given inequation is (-∞, 10/11).

8. (3x - 2)/5 ≤ (4x - 3)/2
Solution:
Given:
(3x - 2)/5 ≤ (4x - 3)/2
Multiply both the sides by 5 we get,
(3x - 2)/5 × 5 ≤ (4x - 3)/2 × 5
(3x - 2) ≤ 5(4x - 3)/2
3x – 2 ≤ (20x - 15)/2
Multiply both the sides by 2 we get,
(3x - 2) × 2 ≤ (20x - 15)/2 × 2
6x – 4 ≤ 20x – 15
20x – 15 ≥ 6x – 4
20x – 15 + 15 ≥ 6x – 4 + 15
20x ≥ 6x + 11
20x – 6x ≥ 6x + 11 – 6x
14x ≥ 11
Divide both sides by 14, we get
14x/14 ≥ 11/14
x ≥ 11/14
∴ The solution of the given inequation is (11/14, ∞).

9. –(x – 3) + 4 < 5 – 2x
Solution:
Given: –(x – 3) + 4 < 5 – 2x
–x + 3 + 4 < 5 – 2x
–x + 7 < 5 – 2x

–x + 7 – 7 < 5 – 2x – 7
–x < –2x – 2
–x + 2x < –2x – 2 + 2x
x < –2
∴ The solution of the given inequation is (–∞, –2).

10. x/5 < (3x-2)/4 – (5x-3)/5
Solution:
Given: x/5 < (3x-2)/4 – (5x-3)/5
x/5 < [5(3x-2) – 4(5x-3)]/4(5)
x/5 < [15x – 10 – 20x + 12]/20
x/5 < [2 – 5x]/20
Multiply both the sides by 20 we get,
x/5 × 20 < [2 – 5x]/20 × 20
4x < 2 – 5x
4x + 5x < 2 – 5x + 5x
9x < 2
Divide both sides by 9, we get
9x/9 < 2/9
x < 2/9
∴ The solution of the given inequation is (-∞, 2/9).

11. [2(x-1)]/5 ≤ [3(2+x)]/7
Solution:
Given:
[2(x-1)]/5 ≤ [3(2+x)]/7
(2x - 2)/5 ≤ (6 + 3x)/7
Multiply both the sides by 5 we get,
(2x - 2)/5 × 5 ≤ (6 + 3x)/7 × 5
2x – 2 ≤ 5(6 + 3x)/7
7 (2x - 2) ≤ 5 (6 + 3x)
14x – 14 ≤ 30 + 15x
14x – 14 + 14 ≤ 30 + 15x + 14
14x ≤ 44 + 15x
14x – 44 ≤ 44 + 15x – 44
14x – 44 ≤ 15x
15x ≥ 14x – 44
15x – 14x ≥ 14x – 44 – 14x
x ≥ –44

∴ The solution of the given inequation is [–44, ∞).

12. 5x/2 + 3x/4 ≥ 39/4
Solution:
Given:
5x/2 + 3x/4 ≥ 39/4
By taking LCM
[2(5x)+3x]/4 ≥ 39/4
13x/4 ≥ 39/4
Multiply both the sides by 4 we get,
13x/4 × 4 ≥ 39/4 × 4
13x ≥ 39
Divide both sides by 13, we get
13x/13 ≥ 39/13
x ≥ 39/13
x ≥ 3
∴ The solution of the given inequation is (3, ∞).

13. (x - 1)/3 + 4 < (x - 5)/5 – 2
Solution:
Given:
(x - 1)/3 + 4 < (x - 5)/5 – 2
Subtract both sides by 4 we get,
(x - 1)/3 + 4 - 4 < (x - 5)/5 – 2 – 4
(x - 1)/3 < (x - 5)/5 – 6
(x - 1)/3 < (x – 5 - 30)/5
(x - 1)/3 < (x - 35)/5
Cross multiply we get,
5 (x - 1) < 3 (x - 35)
5x – 5 < 3x – 105
5x – 5 + 5 < 3x – 105 + 5
5x < 3x – 100
5x – 3x < 3x – 100 – 3x
2x < –100
Divide both sides by 2, we get
2x/2 < -100/2
x < -50
∴ The solution of the given inequation is (-∞, -50).

14. (2x + 3)/4 – 3 < (x - 4)/3 – 2
Solution:
Given:
(2x + 3)/4 – 3 < (x - 4)/3 – 2
Add 3 on both sides we get,
(2x + 3)/4 – 3 + 3 < (x - 4)/3 – 2 + 3
(2x + 3)/4 < (x - 4)/3 + 1
(2x + 3)/4 < (x – 4 + 3)/3
(2x + 3)/4 < (x - 1)/3
Cross multiply we get,
3 (2x + 3) < 4 (x - 1)
6x + 9 < 4x – 4
6x + 9 – 9 < 4x – 4 – 9
6x < 4x – 13
6x – 4x < 4x – 13 – 4x
2x < –13
Divide both sides by 2, we get
2x/2 < -13/2
x < -13/2
∴ The solution of the given inequation is (-∞, -13/2).